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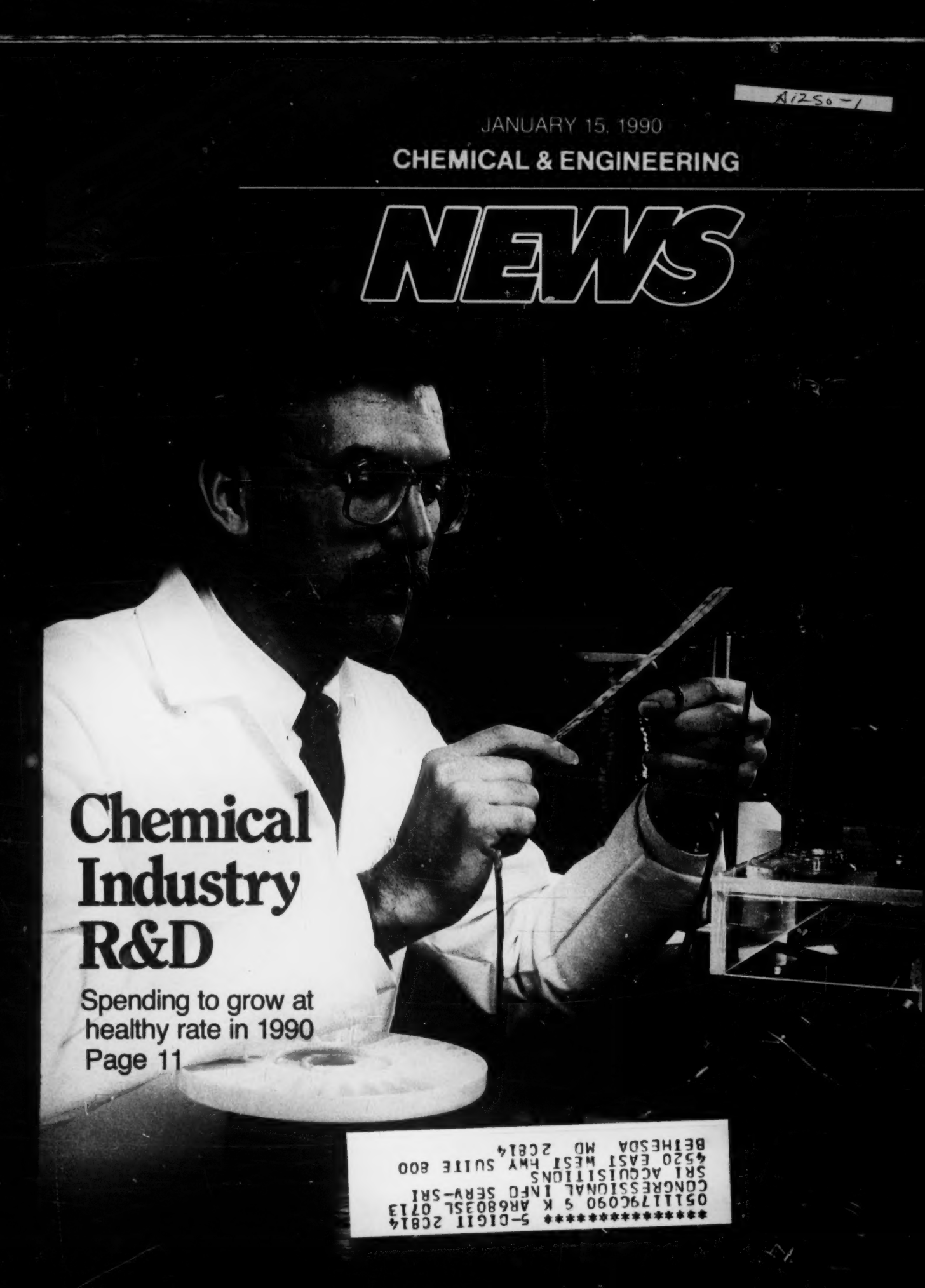
JANUARY 15, 1990

CHEMICAL & ENGINEERING

NEWS



Chemical Industry R&D

Spending to grow at healthy rate in 1990

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NEWS
JANUARY 15, 1990

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Science/Technology

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Chemical & Engineering News

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LETTERS

Ammonia does burn

SIR: In a Government Concentrates column (C&EN, Aug. 7, 1989, page 23), a note was presented that ammonia has been classified as a "nonflammable gas" by the Department of Transportation.

That's odd, because liquid ammonia was the fuel, along with liquid oxygen, for the National Aeronautics & Space Administration's X-15 rocket research aircraft of the 1960s. The oxygen and ammonia were ignited by a high-energy spark plug. I'm sure propane, etc., are more easily ignited, but the stuff does burn.

Ernest J. Tews
South Plainfield, N.J.

Higher education ignored

SIR: The "1990 Employment Outlook" (C&EN, Oct. 23, 1989, page 22) provided not only an excellent overview of the chemistry and chemical engineering fields, it highlighted some deep problems that the government has exacerbated and that the scientific community has ignored.

Nearly one year ago to the day, C&EN published responses of George Bush and Michael Dukakis to queries about science and technology policy in "Presidential Candidates Give Views on Science Issues" (C&EN, Oct. 17, 1988, page 7). I wrote to the editor that as a graduate student I did not believe the rhetoric of either. One year later, it seems that I have been vindicated. Bush probably will not double the National Science Foundation's budget within five years. Although he did convene an "education summit," he made no commitments and totally ignored higher education. Similarly, Dukakis has been defanged politically by the collapse of the "Massachusetts Miracle." As a result, he has started to dismantle the state's higher education system, one of the few bright spots in this state's reputation and economy. To make matters worse, he has removed, inadvertently, state income tax exemptions for graduate student stipends and employer-provided education assistance. Due to the depth of the fiscal crisis, the income tax rates have been increased 15%.

Graduate students have been hurt by stipends that have failed to keep up with inflation (especially that in Boston) by the recently imposed federal income tax on stipends after the Tax Reform Act of 1986, and most recently by the state income tax on stipends. We have seen real income decrease precipitously in the past five years. Starting salaries for B.S. degrees in chemistry and chemical engineering are double and treble, respectively, graduate student stipends. Is it so surprising that NSF projects Ph.D. deficits of 14,000 at current stipends and 7800 at higher stipends (whatever that means) by the year 2006? Is it so surprising that industry is increasing university research funding when cost and proprietary rights differentials between graduate students and industrial chemists and chemical engineers are growing?

Educational crises exist at all levels of education in the U.S. and have profound implications for this country's future. Elementary and secondary education receive much attention and rhetoric, but even if these are corrected, who is going to educate future college and graduate students? University faculty, not to mention several scientific journals, have been disturbingly quiet about the effects of the Tax Reform Act of 1986 and the Technical Amendments Act of 1988 on graduate student enrollment and faculty recruitment. Do they think that as long as they got theirs, what happens to us does not matter? Such an attitude, if it exists, is not only selfish, it is extremely myopic. Moreover, it threatens to cannibalize higher education.

David Wagger
Cambridge, Mass.

Chemistry graduate students

SIR: I wish to respond to recent letters, as well as the letter by Dennis Sardella (C&EN, Nov. 20, 1989, page 3) concerning the lack of interest in sciences among American students. As a graduate student, it is quite obvious to me why there is not a great interest in careers in science, specifically chemistry, at the graduate and undergraduate level. Although I find my research very interesting and challenging, I still find myself and my coworkers muttering, "What am I doing here?"

The major reason for this is not a lack of interest, but a lack of incentive. Students are able to obtain degrees in law, medicine, dentistry, and management in much less time and with less work than in the less lucrative field of chemistry. Many of these people will have starting salaries that are not attainable by chemists even after many years as industrial chemists—not to mention the poor starting salaries for untenured faculty.

I have been in graduate school now for more than three years and I have no idea how much longer I will be a graduate student or whether I will ever

Chemical Industry R&D Spending Continues To Climb

Nine major chemical firms plan 7% boost in research expenditures in 1990, up from 6% increase for same companies last year

Marc S. Reisch,
C&EN Northeast News Bureau

Major U.S. chemical and diversified companies plan a healthy increase in research and development spending in 1990. According to a recent survey by C&EN, R&D spending for nine chemical firms will rise 7% from 1989, up from a 6% increase for the same nine firms last year.

From a different survey, the Chemical Manufacturers Association projects a 5% R&D spending increase in 1990 for chemical companies with sales under $1 billion and a 7% rise for firms with sales over $1 billion—a finding in close agreement with C&EN's projection this year.

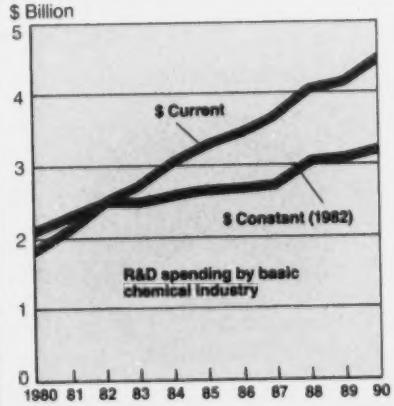
However, although CMA projects 1989 R&D expenditures rose 10% or more from the previous year, C&EN's recent survey finds that companies spent less on R&D in 1989 than they originally anticipated a year ago. Last year, 10 reporting companies anticipated increasing R&D expenditures 9% over 1988 (C&EN, Jan. 16, 1989, page 15)—a spending increase not far off CMA's 10% increase. However, in contrast, C&EN's survey this year finds that 10 responding companies increased 1989 expenditures only 4%. In constant dollar terms, based on Battelle Columbus Laboratories' cost of research and development index for all industry, that marked a mere 2% increase in research expenditures in 1989 in contrast to the 7% increase planned a year ago.

If, as CMA asserts, R&D expenditures are an important key to the international competitiveness of the U.S. chemical industry, why does it appear, according to C&EN's survey, that R&D was not so well supported in 1989 as first anticipated? And, although companies project a healthy 1990 increase in expenditure levels, will they revise their current rosy spending levels downward when the numbers start coming in next year at this time?

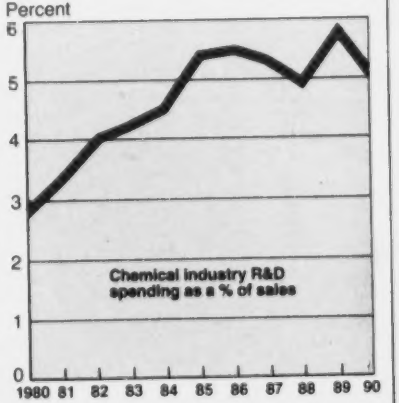
The answers may have partly to do with the availability of new scientists entering the job market. In fact, chemical companies may not have been able to spend the money they had budgeted to hire new scientists in support of their R&D programs, particularly in the early part of 1989 when the level of sales for the industry continued to bode well for the industry's long-term health. According to the National Center for Education Statistics, fewer bachelor's degrees in chemistry and chemical engineering were awarded in 1987 (the latest year for which data are available) than were awarded in the early years of the decade (C&EN, Aug. 21, 1989, page 55). And although the number of masters and Ph.D.s awarded in chemistry and chemical engineering have either remained stable or increased slightly, the pool of graduating chemists and chemical engineers in all degree categories has declined from 22,668 in 1980 to 20,039 in 1987.

At the same time as the pool of graduating chemists and chemical engineers decreased, the National Science Foundation notes that the annual rate of retirement of Ph.D. scientists and engineers has edged up gradually and that in 1987 over one half of doctoral scientists and engineers were 45 years of age or older (C&EN, June 12, 1989, page 17). Although the number of R&D scientists in the chemicals and allied products category has increased from 51,400 in 1980 to 73,000 in 1987, according to NSF (C&EN, Aug. 21, 1989, page 50), industry has to compete for a declining population of qualified personnel who may also

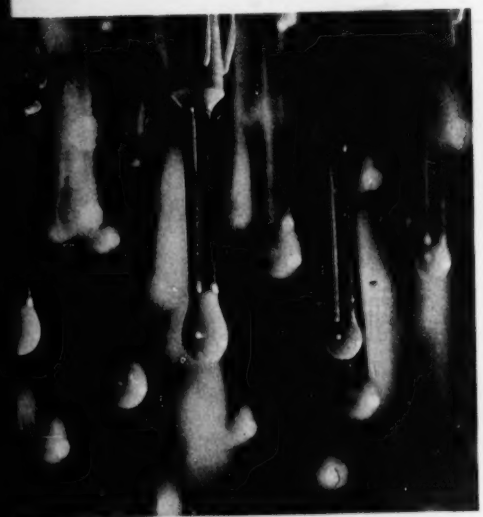
R&D spending continues steady rise in 1990 . . .



. . . but will slip as percent of company sales



Note: For 12 chemical companies listed on page 13. **Sources:** C&EN surveys and estimates, Battelle Columbus Laboratories



W. R. Grace's new biological fungicide, being prilled here, is aimed at soil-borne plant diseases

choose to enter either academia or government research.

Thomas Regino, manager of technology assessment for Kline & Co., a Fairfield, N.J.-based consulting firm, warns that chemical companies can expect spot shortages of available scientists to continue in the next decade. Regino and his firm have been working on an as yet unfinished American Chemical Society survey, "Evolution within the Worldwide Chemical Community." As part of that survey, he finds that U.S. "chemical companies hire talent on an as-needed basis. There is no master plan we can detect for hiring scientists who will be needed at major chemical companies."

Another possible reason for the apparent slowdown in 1989 R&D spending compared with earlier projections may have to do with the slowdown of the economy in the latter part of 1989. Management will, in fact, pull back the level of its R&D expenditures when industry appears to slow and increase it as the economy improves. The most vivid example occurred in the early part of the past decade when the most recent recession pushed R&D as a percentage of future-oriented expenditures (capital expenditures plus R&D expenditures) as low as 19% in 1980, compared with a high of 40% in 1987 when more favorable economic conditions prevailed, and to 34% in 1989.

A downward revision in R&D expenditures in 1990 may still be seen when C&EN again reviews the numbers next year if the current slowdown continues or worsens. The good news, however, is that the chemical companies surveyed still plan nominal and real increases in R&D. By comparison, a survey of the same group forecasts capital expenditures up 12% in 1990 compared with 1989. Adjusting for two unusual exceptions, however, six out of eight reporting companies show an average nominal decline of 0.5% in 1990 capital expenditures (C&EN, Dec. 18, 1989, page 9). Factoring in inflation, the outlook for capital expenditures appears even worse.

Economic factors also are an important element in just where research is conducted. Though C&EN's R&D survey does not break out how much is spent in the U.S. as opposed to spending abroad on R&D, it's true that the trend toward globalization has encouraged U.S.-based companies not only to invest overseas but also to set up research efforts there. As U.S. companies gain position in other countries, they may be tempted to set up more R&D ventures there to serve local customers' technical requirements, and also to take advantage of one or another country's perceived advances in a developing specialty or its local pool of scientists.

In an attempt to preserve a U.S. margin of competitiveness with research abroad, the Council on Research & Technology (CORETECH)—a coalition of over 165 companies, universities, research institutions, and trade associations—has organized to preserve, among other things, a 20% federal R&D tax credit to companies for increases in qualified R&D expenditures. The credit was first established as part of the Reagan Administration's tax package in 1981.

According to Kenneth R. Kay, CORETECH's executive director and a partner with the law firm of Preston, Gates, Ellis & Rouvales Meeds, Washington, D.C., Congress did extend the tax credit to the end of 1990 after some uncertainty late last year resulting from U.S. budgetary considerations. Kay says the group, which includes pharmaceutical, biotechnology, chemical, and other industry members, hopes to see the credit made a permanent part of U.S. tax law.

With more than half of surveyed companies forecasting double-digit increases in R&D spending for 1990, a federal tax credit extended at least through this year, and Battelle's forecast for industry R&D inflation of 2.4% for 1990, the chemical industry's R&D efforts this year could get a real boost. Among chemical companies surveyed by C&EN, W. R. Grace plans the biggest increase in R&D spending with a budget at $145 million, 11.5% above its 1989 spending level. The 1990 increase follows a 9.2% increase the year before.

Dow Chemical plans the second biggest gain in 1990, with its R&D funding rising 11.4% to $950 million. That increase follows a hefty 10.5% rise the year before when the company figures it spent $853 million on R&D.

Also planning a double-digit increase in R&D funding is American

R&D nearly doubles as percent of future-oriented spending

Note: For 12 chemical companies listed on page 13. **Source:** C&EN surveys and estimates

Several companies project double-digit R&D increases for this year

$ Millions	Planned 1990	Actual 1989	Planned 1989	1988	1987	1986	1985	1984	Change from previous year 1990	Change from previous year 1989	R&D spending as % of sales 1989	R&D spending as % of sales 1988
CHEMICAL COMPANIES												
Air Products[a]	$ 71	$ 71	$ 72	$ 72	$ 57	$ 61	$ 51	$ 44	0%	−1.4%	2.8%	3.0%
American Cyanamid	450	405	385	365	314	278	251	232	11.1	11.0	8.3	7.9
Dow Chemical	950	853	850	772	670	605	547	507	11.4	10.5	4.8	4.6
Du Pont[b]	1380	1320	na	1319	1223	1156	1144	1097	4.5	0.1	6.1	6.5
Ethyl[c]	65	59	58	53	50	47	47	40	10.2	11.3	2.7	2.5
W. R. Grace	145	130	132	119	107	94	92	81	11.5	9.2	2.1	2.1
Hercules	na	na	na	74	74	71	76	72	na	na	na	2.6
Monsanto	na	600	615	648	615	596	470	370	na	−7.4	6.8	7.8
Olin	65	65	65	58	62	56	53	52	0	12.1	2.7	2.5
PPG Industries	250	250	250	227	227	204	176	150	0	10.1	4.2	4.0
Rohm & Haas	180	170	185	156	142	133	124	109	5.9	9.0	6.3	6.2
Union Carbide	na	na	193	159	159	148	275	265	na	na	na	1.9
TOTAL	**$3556**	**$3923**	**$2805**	**$4022**	**$3700**	**$3449**	**$3306**	**$3019**			**5.9%**	**4.9%**
ANNUAL CHANGE[d]	**7%**	**4%**		**9%**	**7%**	**4%**	**10%**	**12%**				
DIVERSIFIED COMPANIES												
Allied-Signal[e]	650	600	600	647	400	360	298	258	8.3	−7.3	4.8	5.4
Arco Chemical	na	na	44	39	29	32	29	29	na	na	na	1.4
Eli Lilly	na	600	600	500	466	427	370	341	na	20.0	13.9	12.3
FMC	155	148	na	144	132	146	149	121	4.7	2.8	4.2	4.4
Merck & Co.	na	755	na	650	566	480	426	393	na	16.2	12.0	10.9
Morton International[e,f]	50	38	na	35	31	29	34	28	31.6	8.6	2.7	2.9
Schering-Plough	370	330	na	298	251	212	189	173	12.1	10.7	10.0	10.0
TOTAL	**$1225**	**$2471**	**$1244**	**$2313**	**$1875**	**$1686**	**$1495**	**$1343**			**7.9%**	**7.2%**
ANNUAL CHANGE[d]	**10%**	**9%**		**23%**	**11%**	**13%**	**11%**	**13%**				

a For fiscal year ended Sept. 30. b All figures exclude Conoco. c 1989 and 1990 figures adjusted to reflect spin-off of Tredegar Industries in July 1989. d For those companies reporting. e Includes all company-financed R&D, but excludes contract R&D. f Fiscal year ended June 30. Figures adjusted to 1986 in order to reflect division of Morton Thiokol into Morton International and Thiokol Corp. in July 1989; 1984 and 1985 figures are for Morton Thiokol. na = not available.

Cyanamid, with an 11.1% increase to $450 million. That increase follows a similarly large 11% increase the previous year when the company spent about $405 million, 5% more than it originally planned to spend when it participated in last year's survey.

Ethyl plans a large increase in 1990 R&D spending, too, with a preliminary budget of $65 million, up 10.2% from its year-earlier level. Its 1989 R&D budget was similarly large, up 11.3% from the year earlier to $59 million. Ethyl's 1989 and 1990 numbers reflect the spin-off last summer of Tredegar Industries. Earlier years include the aluminum, plastics, and energy groups now no longer part of Ethyl's business. With R&D spending levels at about 2.7% of sales in 1989 and 2.5% of sales in 1988, Ethyl is still on the low end of R&D investment in its businesses compared with the group average of about 5.9% in 1989 and 4.9% in 1988.

Falling below the average increase for the nine chemical companies is Rohm & Haas, which plans to spend $180 million in 1990, up only 5.9% compared with the $170 million it spent in 1989, which was up 9% compared with 1988. Despite the 1990 slowdown in R&D expenditures, Rohm & Haas still rises above the average for the group in terms of R&D spending as a percentage of sales, with 6.3% of sales devoted to R&D in 1989 and 6.2% of sales devoted in 1988.

Du Pont plans a 4.5% increase in R&D spending for 1990, although that increase is on a very large base. The company will spend $1.38 billion in 1990, compared with $1.32 billion in 1989. Its 1989 spending was only 0.1% above that in 1988.

Three companies say they plan no increase or decrease in R&D spending for 1990—Air Products & Chemicals, Olin, and PPG Industries. In contrast, in 1989 Air Products decreased its spending 1.4% from 1988, as Olin increased its spending 12.1% and PPG increased its spending 10.1%.

Hercules, Monsanto, and Union Carbide were unable to provide an early estimate of their R&D spending for 1990. Of the three, only Monsanto could estimate that in 1989 it spent $600 million on R&D, down 7.4% from 1988.

Among diversified manufacturers, four companies responding to the survey—Allied-Signal, FMC, Morton International, and Schering-Plough—plan to increase their R&D budgets an average of 10% in 1990. Their figures include internally generated R&D projects only and not government contracts.

Morton International reported the largest increase in R&D for the group of diversified manufacturers. Morton International figures from 1986 to the present exclude the aerospace business previously a part of Morton-Thiokol. As a result of the spin-off of Thiokol Corp. in July last year, two renamed firms now exist. As Morton International focuses on its specialty chemicals, salt, and inflatable restraint systems, it now devotes about 2.7% of sales to R&D spending for 1989, following a 2.9% level in 1988. Those figures are up from the 2% Morton-Thiokol reported in last year's survey. □

Mass Terminations of Chemists Hold at Relatively Low Level

Although it will be of little comfort to chemists who are still losing their jobs because of corporate restructurings and reorganizations, the lull in mass terminations of chemical professionals is apparently continuing. The latest report on such terminations by ACS's Committee on Professional Relations (CPR), the first in more than a year, covers five such incidents involving a total of about 45 chemical professionals.

The previous report (C&EN, Dec. 19, 1988, page 42) also covered only five terminations involving about 40 terminees. From 1979 through 1988 there had been two reports per year. These typically each covered about 10 terminations and, in some cases, involved a total of more than 200 terminees.

CPR states it is "pleased to note that the relatively low number of multiple terminations reported for investigation continues, as does the relatively low number of chemical professionals involved."

However, the committee continues to be distressed about the treatment of older chemists. The committee points out that a high percentage of the chemists and chemical engineers still losing their jobs in mass terminations have more than 10 years of service.

CPR defines a mass termination as a situation in which an employer terminates within a six-month period three or more chemical professionals for reasons other than continuing evidence of previously documented inadequate performance, completion of a contract, or cause.

The committee's latest report is the 29th in a series dating back to 1974. Each compares the treatment of those being terminated with standards contained in ACS's Professional Employment Guidelines (PEG). These standards cover advance notice, severance pay, assistance in finding new employment, pension vesting, length of terminees' service, and extension of protection plans. They were complied with an average of 47% of the time in the latest report. This is essentially the same as the 48% average for the previous 28 reports.

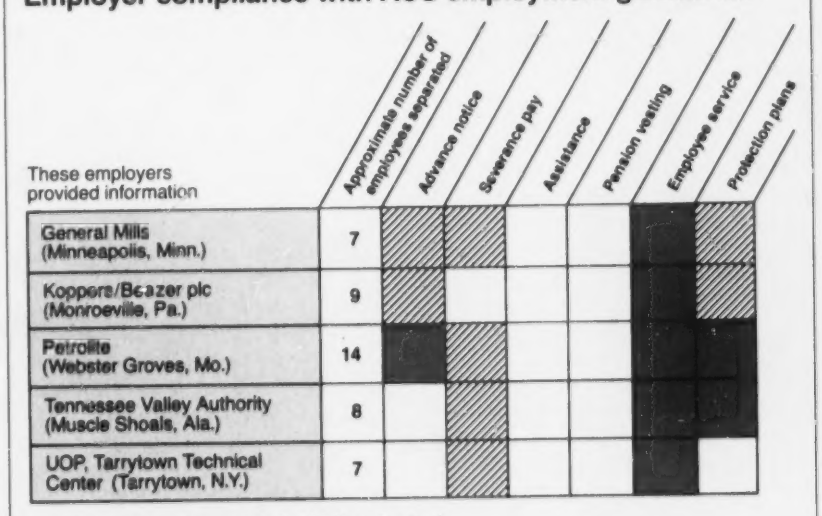
The terminations covered by the latest report occurred at General Mills, Koppers, Petrolite, Tennessee Valley Authority, and UOP between June 1988 and April 1989. They involved from seven chemical professionals at both General Mills and UOP to 14 at Petrolite.

CPR seeks information on terminations from terminees themselves as well as from employers and ACS local sections. The committee also welcomes information from individual society members. All five employers involved provided at least partial information for the latest report. The St. Louis and Wilson Dam local sections assisted CPR by helping to identify terminees.

Of the six PEG termination standards, those concerned with pension vesting and assistance in obtaining new employment are generally complied with very well. They were both met in all cases in the latest report. The standards on advance notice and the extension of protection plans have been complied with in 40% and 49%, respectively, of all terminations to date.

However, it is still the exceptional employer that complies with the

Employer compliance with ACS employment guidelines



☐ Employer met or exceeded guideline standard.

▨ Two or more individuals below guideline standard, but average experience better than "substantially below" criterion.

■ Employer was substantially below guideline standard, which is defined as follows:

- Advance notice—less than two weeks.
- Assistance—no assistance rendered.
- Severance pay—less than one week per year of service.
- Employee service—more than 40% of terminees had 10 or more years of service.
- Protection plans—no continuation of protection plans.

ACS guidelines

Advance notice. Four-week minimum.

Severance pay. Minimum is two weeks per year of service. Additional notice may be given, by mutual agreement, in lieu of severance pay.

Assistance. Efforts should be made to place terminee in another position within the organization, or terminee should be given assistance to find employment elsewhere.

Pension plan vesting. Full vesting after five years' service.

Employee service. Those with minimum of 10 years' service should not be terminated except for continued evidence of previously documented inadequate performance or cause.

Employee protection plans. Should be extended for a minimum of one month, plus two weeks for each year of employee service, following termination, at same rate of contribution as before. Employee would have additional 31-day grace period.

standards covering severance pay and the firing of older, more experienced chemists. The severance pay standard calls for a minimum of two weeks' pay per year of service. Only 22% of employers covered by all 29 reports have complied. However, compliance has been improving. It has averaged 31% since 1982.

The PEG standard on employee service states that chemical professionals with a minimum of 10 years' service should not be terminated, except for inadequate performance or cause. Long-term compliance has been at 23%. But in recent years it has been getting considerably worse. It has averaged only 10% since 1985. All five employers in the latest report violated this standard. In four of these cases almost all the terminees apparently had more than 10 years of service.

Copies of termination reports as well as a summary list of all terminations are available on request from the American Chemical Society, Office of Professional Services, 1155—16th St., N.W., Washington, D.C. 20036.

Michael Heylin

Colloid and surface chemistry fellowship

Henkel Corp. is sponsoring an annual two-year graduate fellowship award in colloid and surface chemistry, to be administered by the ACS Division of Colloid & Surface Chemistry.

Each fellowship will consist of $20,000 each year for two years to be used entirely for the fellow's stipend, scientific travel, and other direct research costs. The award is intended to support outstanding graduate students during their final two years (preferably, their third and fourth years) of doctoral thesis research. This research must represent a significant advance in understanding fundamental chemical processes in interfacial systems. Applicants must be enrolled in a full-time graduate program leading to a Ph.D. degree at an accredited university within the U.S.

Applicants must independently prepare a proposal based on their thesis research plans. Documents should contain

- a 100-word research proposal abstract;
- a detailed research proposal (eight double-spaced pages maximum) with a background and literature survey, specific project goals, methods and critical scientific decision points, and required equipment and supplies;
- a brief (one to two paragraph) statement of career goals and how this fellowship can contribute to achieving these goals;
- a project budget delineating the distribution of funds among stipend, travel, equipment, supplies, and other direct costs along with a letter of budget approval from the department chairman (the funds may not be used for overhead costs, or tuition and fees, which must be waived by the university);
- a curriculum vitae, with reprints of any publications, and undergraduate and graduate transcripts; and
- letters of recommendation from the research adviser and two additional references (research adviser to include a statement of available research facilities).

For funding to commence in the fall semester 1990, three copies of the above documents must be submitted by the deadline of Feb. 1 to the selection committee chairman, David I. Devore, Henkel Corp., 300 Brookside Ave., Ambler, Pa. 19002, phone (215) 628-1586. □

Award nominations for ag or food chemistry

The ACS Division of Agricultural & Food Chemistry is sponsoring awards to encourage undergraduate and graduate research in the fields of agricultural and food chemistry and to recognize with these awards students doing outstanding research in these areas.

The undergraduate and graduate awards provide $250 and $750 cash, respectively, and a maximum of $750 for expenses for a student to attend the fall meeting of the American Chemical Society to present a paper on his or her research and to receive a certificate in recognition of this outstanding achievement in undergraduate or graduate research.

To be eligible for the undergraduate award, the applicant must be a junior or senior at the time he or she applies and doing research in the area of agricultural or food chemistry in the U.S.

To be eligible for the graduate award, the applicant must have completed at least one and one half, and preferably two, years of graduate study in any department at the time of application, provided the research is mainly chemical and agricultural or food related.

Applications must be received on or before Feb. 15, so that the winner(s) may present their research talks at the fall ACS meeting to be held in Washington, D.C., Aug. 26–31.

For further details, address all inquiries to Harold E. Swaisgood, Department of Food Science, North Carolina State University, Box 7624, Raleigh, N.C. 27695-7624, phone (919) 737-2968. □